Temiskaming and Northern Ontario Railway Commission.

ONTARIO GOVERNMENT RAILWAY
SIR JAMES P. WHITNEY, Premier.

REPORT ON

JAMES BAY SURVEYS

EXPLORATION:
COCHRANE TO JAMES BAY.

JUNE 9th to SEPT. 12th, 1911

BY

SYDNEY C. ELLS.

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

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By SYDNEY C. ELLS.

OTTAWA, Oct. 14th, 1911.

In accordance with instructions of June 3rd, I left Cochrane on the 9th of June, travelling northward via the Frederick House, Abitibi and Moose Rivers. The party consisted of four men besides myself, this number being augmented from time to time as circumstances required. Returning via the Mettagami River, I again reached Cochrane on the 12th of Sept., having been absent fourteen weeks. Of this time, four weeks were spent in actual travel between Cochrane, Hannah Bay and Moose Factory, and seven weeks in considering the possibility of securing terminal and harbor facilities at Moose Factory or Hannah Bay. The remaining three weeks were devoted to a brief examination of the country immediately adjacent to the route of travel followed. The trip throughout was, I may say, uneventful and free from accident of any sort.

The season's operations thus fall naturally into two divisions: (1st) An investigation of the possible harbor facilities at James Bay, and (2nd) a general consideration of the character and resources of the country lying immediately to the south of the Bay.

POSSIBLE HARBOR FACILITIES ON JAMES BAY.

From time to time and in a very general way in considering a possible terminus on tide water at James Bay, the estuaries of three rivers—the Albany, the Moose and the Harricanaw—have usually been mentioned. All three streams are of considerable size, are old-established canoe routes—especially the Albany and the Moose—and all lie within the boundaries of the Province of Ontario. Incidentally, it may be said that, apart from these three locations, there is absolutely [illegible] point on James Bay (and within the boundaries of this Province) where [illegible] to exist

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In the case [illegible] the estuaries of the Moose and of the Harricanaw, conditions appeared somewhat more favorable. Preliminary surveys were, therefore, made at these two points. The plans which are the result of this work are submitted herewith, and will serve to roughly illustrate such relative as well as absolute advantages as may be looked for at either of these places. In each case some uncertainty still exists regarding the exact range of spring and neap tides, all observation regarding rise and fall being made during the progress of the surveys, and, therefore, extending but a limited period.

ADDENDUM

The originals of the maps accompanying this Report are drawn to scale 800 feet to the inch, but as they have been reduced two and one-half times, the scale is 2,000 feet to the inch.

JAMES BAY SURVEYS

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Regarding the first of these—the Albany River—the stream is for a distance of several miles above its mouth divided into minor channels by numerous islands. The force of the main volume of the river is thus dissipated, with the natural result that many bars and shoals everywhere obstruct the narrow channels. At the outer bar, sailing boats drawing three feet of water must wait for the tide before coming in. In the face of existing conditions, it is indeed difficult to understand why the estuary of the Albany should ever have been seriously considered as a possible harbor site.

In the case of the two remaining possibilities, the estuaries of the Moose and of the Harricanaw, conditions appeared somewhat more favorable. Preliminary surveys were, therefore, made at these two points. The plans which are the result of this work are submitted herewith, and will serve to roughly illustrate such relative as well as absolute advantages as may be looked for at either of these places. In each case some uncertainty still exists regarding the exact range of spring and neap tides, all observation regarding rise and fall being made during the progress of the surveys, and, therefore, extending over but a limited period.

Going down Frederick House River, June 10th, 1911.

Above Long Point, Abitibi River.

For all practical purposes, however, the figures noted on the plans may be taken as correct. Equinoctial springs are said to cause exceptionally high tides for a period of two to three days. As those tides are of short duration, and may be looked for at more or less definite and fixed intervals, their effect need not be seriously considered at the present time.

(1) Estuary of the Moose River.

(*a*) *General Description.*—The Moose River enters James Bay through a wide, low lying, level tract of country, and with no prominent, well-defined banks to control the force of its current. Such topographical conditions could naturally have but one result, that is, a wide and extensive estuary with numerous bars crowding its shoal waters.

Six miles inside an outer bar, which marks the outer limit of the estuary, the river has a breadth of 3½ miles. At 18 miles up stream it still maintains a breadth of three miles, and at 26 miles, the distance between the east and the west banks, is slightly over 1½ miles. At this latter point the Fishing Tent Rapid, the first swift water on the Moose, lies like a low broad terrace across the river, and establishes the southern limit of tide water. It will thus be seen that the tidal portion of the Moose constitutes a stream of no inconsiderable extent.

Beginning a short distance above the Fishing Tent Rapid, and extending to within a few miles of its mouth, the waters of the Moose River are divided by a long and continuous series of islands and shoals into two distinct channels, usually referred to as the North and South Channels. On the North Channel, the French Trading Co. of Revillon Freres Ltd. have had their post established since 1903. On the South Channel, the Hudson Bay Company post known as Moose Factory has until within recent years (1902) constituted the recognized headquarters of that trading company for all the Hudson Bay territory. It is interesting and significant to note that, in spite of the fact that for upwards of 200 years the Hudson Bay Co.'s ships have been trading in and out of Moose River, no chart or plan of the River has ever been made by that Company, nor is there available a single tidal record.

We thus have in the lower reaches of the Moose River two channels, the North and the South, the waters of both uniting to form the broad estuary at the mouth of the river.

(*b*) *Plan.*—The plan has been drawn on a scale of 800 feet to one inch, with a smaller insert map on a scale of one mile to one inch. On the larger scale plan a provisional channel, showing not less than twelve feet of water at ordinary high tide, has been laid down, and along which several alternative land approaches are indicated. Profiles indicating comparatively the north and south channels have also been drawn. Soundings could of necessity be taken for only a short distance (two miles) beyond the outer bar, but such soundings show a perfectly uniform deepening of the water of 5ft. 6in. per mile. It is, further, worthy of note that vessels, sail or steam, require the pilot's services only after reaching point (A) indicated on the plan.

(*c*) *Townsite.*—With the data at present available regarding the extent and action of spring floods, it is impossible to express a final opinion on the question of a Townsite. It is, however, an established fact that the site of the Revillon Co. trading post has never been flooded in the Spring. Regarding the liability to floods of the ground lying along the river between the above Post and Ships Sands Island, opinions differ. By going inland, however, from the shore of the river for a distance of one-third mile at section B, mile 11.5, it is almost certain that a Townsite, free from the effects of spring water, could be located. Naturally the farther up stream such a point might be selected, the closer could it be taken to the river. It would simply be a case of balancing distance up stream against distance inland from the river. Regarding the character of soil that would be encountered, clay bottom underlying a moderate depth (2-3 ft.) of moss and muck, will be found at any point selected between Ships Sands and the French Post.

(*d*) *Tides and Currents.*—Apart from such superficial observations as could be made during a brief stay of a few weeks, there are, so far as could be learned, no records regarding these very important features.

The range of the rise and fall of all tidal waters is subject to wide variations, this being especially true in the case of river estuaries. Narrowing and widening of the channel, change in the force and direction of wind, as well as variations in barometeric pressure, are the chief influences to be reckoned with. Particularly is the wind an important factor along the shores bordering the wide and comparatively shallow waters of James Bay. As a result, at the mouth of the Moose River, with a heavy north-east or north-north-east wind, the tide may rise through a range of six or seven feet with a subsequent fall, possibly not exceeding two feet. The following time table is based on such intermittent gauge readings as could be taken during parts of July and August, 1911. It is probably subject to more or less modifications with more complete observations:—

Where Observed.	Average range of Neap Tides.	Average range of Spring Tides.
Moose Factory	3.8-4.5 ft.	4.5- 5.5 ft.
Head of Ships Sands.............	5.5-7.0 ft.	7.0- 7.5 ft.
Outer Bar (Estimated)..........	7.0-8.0 ft.	8.0-10.0 ft.

Finally, equinoctial tides usually occur during September, and are effective over a period of not more than 2-3 days. It is unfortunate that no reliable data is available regarding these extreme tides, as, in the selection of any terminal, they must be taken into consideration. The general opinion among residents at Moose Factory and at the Revillon Post is, however, that such tides cover Ships Sands Island to a depth of 2-3 ft., thus implying a range for equinoctial tides of possibly twelve feet.

With an incoming tide the current in the river is reversed as far as the Fishing Tent Rapids, the rate of flow varying from approximately 3 miles per hour at the head of Ships Sands Island to 2½ miles at the Revillon Co. wharf. The rate of combined summer current and ebb tide probably exceeds these figures by ½ mile per hour in each instance. Thus, at any stage of the tide, the current would not effect the steam vessels entering the river or proceeding up stream. Sailing vessels, however, owing to the limited channel at low tide, would have to wait for a fair or quartering wind, or else allow the incoming tide to carry them up to their anchorage. Finally, the very great uniformity at the bottom, as indicated by the soundings, is a matter for no little satisfaction. There are no rips or other tidal currents due to an irregular bottom, and light canoes may navigate any part of the estuary at any stage of the tide in perfect safety.

At low tide, fresh water may always be obtained as far out as the Shears Beacon, but beyond this the water is frequently brackish. At high tide fresh water can

Reapers—Ship Sands Island.

Hay Meadow, Ship Sands.

always be had as far out as Beacon No. 2 and sometimes (depending on the direction of the wind), as far as the Shears Beacon.

(*e*) *Spring Floods.*—Another factor to be carefully considered in the selection of a possible situation for docks are the Spring Floods. Information concerning the effects of these has of necessity been obtained from local residents, supplemented by such evidence as the character and size of standing timber range of pieces of drifted wood and injury done to trees by floating ice. Incidentally the effect of such floods, both in silting up the river bed and in covering the banks of the river, appears to have been rather over-estimated.

Extreme high spring water in the north and south channels of the Moose River, is, as elsewhere, chiefly due to ice jams, and is to that extent preventable. Such blockades are of more frequent occurrence, and, apparently, accompanied by more serious results in the South Channel than in the North Channel, presumably owing to the shallower water found there.

Shoal water, bars, and a considerable change in the direction of the channel near the head of Middleboro, usually causes the ice to jam between that point and Pilgrim Island, on the one hand, and Moose Flats on the other. At such times water may be expected to completely submerge Moose Flats and also to cover Pilgrim and Middleboro Islands to a depth of one to three feet. Moose Island itself is known to have been flooded but once (1895), when water 3-5 feet deep covered the island for several hours. But what is of still greater importance is the fact that the heavier water, naturally forced to the north side of the river, will tend to keep that channel open.

When, however, ice blockades the North Channel, the islands on the side also flood. Jamming, as it usually does, on either side of Butler Island, that island, as well as Charles Island, may have one to two feet of water flowing over them for a period not exceeding one to three days.

Along the North Channel, below Butler Island, the extent to which spring floods inundate the shore could not be determined. The fact, however, that spruce and balm-of-gilead up to 16 inches diameter are found several miles further down stream would seem to indicate that such floods are not of a very serious nature, and certainly not of long duration. In this connection it seems reasonable to suppose that, if desired, the occurrence of such ice jams could be prevented by the judicious use of blasting powder.

Regarding the silting up of the channel and the formation of bars, it is asserted by some of the older pilots at the trading posts that while the South Channel is becoming shallower, the North Channel is, if anything, becoming deeper. It is difficult to say whether actual conditions justify such a statement. It would appear, however, that lacking further and more definite evidence, the difficulties implied by an unnaturally rapid silting up of the channel should not be over-estimated. There is no doubt that, to some extent, continual change takes place in the size and shape of bars and shoals. Naturally the ice forms more or less close to, and in some cases directly on, these bars and shoals, and hence any sediments brought down will tend to accumulate about the head and along the sides of such sheets of anchored ice. The use, if necessary, of wing dams at one or two points would do much to prevent trouble from the above cause.

(*f*) *Ice Conditions.*—The Spring breakup, near the mouth of the Moose River, takes place between April 20th and May 20th, an average date being May 5th. During this breakup the Fishing Tent Rapids serve to disintegrate large cakes of ice coming down stream, and but few pieces 15 ft. across reach either of the trading posts. In point of destructive force, and in the tendency to form ice jams, the spring breakup on the Moose does not, apparently, compare with that which takes place every spring in Montreal, Quebec, or at a number of other Canadian River Ports. This Spring (1911) canoes descended the Misinabie and the Moose from old Brunswick House Post, a distance of over 160 miles, and arrived at Moose Factory on April 31st. It is considered not unusual for canoes from up river to reach this H. B. Co. post by the 10th of May.

Navigation on James Bay itself is said to open sometime in June. From that time on until the end of October there is no hindrance to navigating James Bay, either in coast-wise trade or directly in and out of the Bay. About the middle of October navigation for canoes on the various rivers becomes uncertain, ice forming any time after that date, and by the end of November winter has set in. Ice forms in the river as far up as Fishing Tent Rapids to the thickness of 3½ to 4 feet. Along the shores this ice freezes to the bottom for a distance of 50 to 300 feet from shore, depending on the depth of water. Along the edge of this shore ice a break occurs, the main body of ice in the river rising and falling with the tides; the shore ice is, however, covered by the tides to a greater or less extent. Ice forms also for a distance of probably 50 miles from the shores of James Bay. Winter travel on the Bay on the estuary of the Moose, or on the river itself is perfectly safe during four to five months of the year.

(*g*) *Location of Docks.*—In the present total absence of authentic records regarding the effects of temporary spring floods and of equinoctial tides, no final pronouncement can be made. Along the South Channel the first possible location for a terminal is (as indicated on the plan) in the vicinity of East Point. While possessing certain favorable features, it is obvious that, in point of distance, and in depth of channel, locations (A) and (B), on the North Channel, will afford superior advantages.

(*h*) *Materials.*—Drilling with a view to determining the character of material underlying the entrance and river mouth was attempted on the Sand Head Bar. The rods used, however, proved inadequate to penetrate the stiff blackish clay encountered near the surface. The nearest rock *in situ* that was observed was well bedded and undisturbed, more or less flaggy limestone having a slight dip towards the North-West. This limestone occurs on a point some twelve miles to the East of Sand Head Bar. Toward the South-West the nearest rock in place occurs near the Fishing Tent Rapid, 24 miles up stream. To the West, Maidmans Creek shows no rock in place for a distance of at least six miles from its mouth. To the North-West it is said that no rock occurs for 50 miles from the Sand Head Bar. Thus, there seems no reason, lacking evidence to the contrary, to anticipate that rock will be encountered at any such depth as would be called for, either in deepening a channel through the shoal water at the mouth of the estuary or in excavating for any berths or shore approaches indicated on the plan. Scattered boulders, apparently of a size not exceeding 3 ft. diam. are exposed on the flats at low tide, well to the east and west of the channel. Within a mile, however, of either side of the indicated channel, very few boulders are to be seen.

(*i*) *Materials for Construction.*—Stone for construction purposes is, as indicated above, not available in the immediate vicinity, and will have to be transported a considerable distance. Where found in place, however, it is a bedded limestone that could doubtless be used to advantage. The question of timber is discussed elsewhere in this report. It may be stated here, however, that there will be no difficulty in securing all piling that may be required, and larger timbers up to 20 in. diameter in fair quantity can be floated down the river. It may be here stated that one of the best cuts of logs the H. B. Co. has yet taken out for their sawmill at Moose Factory was from a spruce bluff near East Point, on the South Channel, and less than four miles from the head of Ships Sands Island.

(*j*) *Anchorage.*—As the plan indicates, a wide bar, herein referred to as the Outer Bar, and which is covered at low tide by 6 ft. to 8 ft. of water, lies across the mouth of the Moose Estuary. Towards this bar the winds from the north-east and north-north-east have a reach or fetch of 50 and 100 miles respectively. The maximum effect of storms over a distance of 50 miles would be to raise a sea not exceeding ten feet, while across the greater distance of 100 miles, the maximum height attained by the wave would be approximately 15 ft. Storms having such an effect would obviously be of rare occurrence. If then, we assume, as we may safely do, that a 10 ft. wave will break in on a bar covered by 10 ft. of water, and a 15 ft. wave on a bar covered by 15 ft. of water, the Outer Bar should constitute, even in severe weather, a considerable protection to vessels lying inside. Vessels passing beyond the Sand Head Bar, would, however, be assured of adequate shelter, as the bars and shoals would form an effective breakwater in any weather. The strong heavy clay that appears to underly the estuary of the river should prove an excellent holding ground for anchors.

HARRICANAW ESTUARY—HANNAH BAY.

In its general topographical features, the estuary of the Harricanaw River resembles that of the Moose. For many miles before reaching Hannah Bay the Harricanaw flows through a wide, level track of low-lying alluvial country, finally entering the Bay through a broad estuary more or less choked by bars and extensive shoals. Moreover, like the Moose, the Harricanaw, toward its mouth, also divides to form two very considerable channels on either side of a series of islands and bars. But here the similarity between the estuaries of the two rivers ceases. Fortunately, in the case of the Moose River, the two channels again unite before reaching the mouth of the river, and the combined strength of the total discharge constitutes a force the influence of which is seen in a very considerable channel, free for the most part from obstructing deposits. On the other hand, the two channels of the Harricanaw do not again unite. Once beyond the restraining influence of well defined banks, the erosive force of the divided stream is not sufficient to maintain the channel. It would, therefore, appear that, considering the data at present available, the advantage undoubtedly lies with the estuary of the Moose River.

(*a*) *The Plan.*—The plan of the estuary of the Harricanaw has been drawn on scale of 1 in. to 800 ft. A possible channel is indicated, which, in calm weather, will allow vessels drawing 10 ft. of water to cross the bar at high tide. A few occasional soundings are charted on ranges beyond the outer tidal bars. It is believed that no greater depth of water will be found within the limits of these ranges, and that the deepening of the water seaward will here, as elsewhere about James Bay, be found of sufficient uniformity to allow of interpolating other soundings that will be very approximately correct. Beyond the outer soundings indicated, no information could be obtained with the equipment (small canoes) available. It is, therefore, not known what the conditions may be regarding shoals and bars lying further off shore. A profile showing the depth of channel as laid down on the 800 feet plan has been drawn for purposes of comparison with the channel of the Moose River. All soundings are reduced to low tide level.

Back of Moose Factory.

Factor's House, Moose Factory.

(*b*) *Tides and Floods.*—Tides have a slightly greater range than in the Moose River, and a series of gauge readings taken at the head of Hay Island, July 30th, August 6th, shows a range of 7 ft. to 9 ft, for spring tides and of 5.5 to 7 ft. for neap tides. These figures would probably be increased by 1.5 ft. at the Outer Bar. The effect of spring floods was not determined. Near the head of Hay Island, the site of the abandoned H. B. Co. Post appears to have been free from spring water, and but little trace of the effects of floods was seen over the upper half of the island itself. There is no doubt, however, but that, at extreme stages of water, the island as well as the mainland is for short periods (2—5 days) more or less submerged as far as a point indicated on the plan as mile 6.

(*c*) *Anchorage.*—The bars and shoals would afford adequate shelter from any sea, but the entrance in any but light weather would probably be extremely dangerous. Holding ground for anchors is good and consists of a blue clay at all points examined.

(*d*) *Material.*—The bottom of the channel is everywhere a blue clay. Occasional small areas of gravel with scattered boulders of maximum diameter of 2 ft.—3 ft. are seen on bars exposed at low tide. Otherwise all bars are overlaid by 6 in.—2 ft. of sand. The nearest rock seen in place, an almost horizontally bedded limestone, lies about fifteen miles to the west, and in ascending the river quite 13 miles from the outer bar, no rock exposures were seen. Considering these conditions, then, there seems no reason to anticipate that rock in place would be met with at practicable dredging depths.

(*e*) *Materials for Construction.*—An ample supply of spruce is available for piling, and considerable quantities of scattered spruce up to 20 in. to 24 in. in diameter can be had along the banks of the West and of the Harricanaw Rivers. Rock (limestone) is available on an exposed shore 14 or 15 miles to the west of the river mouth.

(*f*) *Townsite.*—It is doubtful if any ground suitable for a Townsite could be secured below the head of Hay Island. Terminals and landing facilities could be arranged not far from the point indicated on the plan as mile 7. Fresh water can be had at almost any stage of the tide for some distance out beyond the mouth of the West River.

The Character and Resources of the Country Lying Immediately to the South of James Bay.

Generally speaking, the possible natural resources of a new country such as that under consideration may be stated as falling under three chief heads:—

(1) Resources depending for their value on Agriculture.
(2) Resources depending for their value on Economic Minerals.
(3) Resources depending for their value on Timber.

(1) In considering the possible agricultural resources of that portion of Northern Ontario lying immediately to the south of James Bay, my conclusions are based on such data as could be gathered during a part of the present season, in addition to such observations as I had made during previous private explorations in that section of the country. To explore in detail a region having the wide extent of that under consideration was quite out of the question. I, therefore, selected a limited area which I have considered as constituting a small section of a possible Railway belt, and examined this tract of country in as much

detail as time would allow. The area thus visited and the position of the traverses made have been indicated on Map No. 3 enclosed herewith. In adapting this line of procedure I have made the necessary assumption (and from my knowledge of the country I believe the assumption is correct) that, considered radially from James Bay, there is a considerable uniformity in the timber and land conditions over wide areas. Thus, I have assumed that conditions which are known to prevail in the strip of country indicated on Map No. 3 and at points say thirty miles or forty miles or fifty miles south of Moose Factory between the Abitibi and the Mettagami, will also, at similar distances, apply fairly well to the country between the Abitibi and the French, or between the Mettagami and the Masinabie. At these distances of thirty or forty or fifty miles from Moose Factory, minor variations will be found depending on primary and secondary drainage; but, in the main, I believe the above assumption will hold good. Thus, if we have a 5 ft. muskeg at a distance of thirty miles south of James Bay, I would look for a similar condition East and West along a belt roughly parallel with the shores of the Bay, or, in other words, radially from the Bay. This assumption I have based on the fundamental principle that the country adjacent to James Bay on the South and West side is gradually being elevated.

Note.—More correctly speaking, the waters are receding from the shore. One explanation is that the weight of the great antarctic ice cap, possibly two miles in thickness, may cause a change or shift in the position of the centre of gravity of the earth, and result in a consequent and proportionate lowering of the waters in certain parts of the northern regions.

For, if such is the case, it will naturally follow that those areas, most recently elevated above tide water, will have had the least time and opportunity to accumulate on their surfaces masses of moss and of peat. On such areas the depth of moss and peat will be less in proportion than it is on the older areas. Thus, as we leave the shores of James Bay, the depth of the muskeg should gradually increase, and it will be observed that the figures indicated on Map No. 3 roughly bear out this assumption. Eight miles to the west of Moose Factory the depth of moss and muck is 2 ft. to 3 ft.; 10 miles further south the depth is 2 ft. to 4ft.; and 40 miles, 4½ to 5 ft.; at 60—80 miles, 5½ to 6 ft.; and at 90 miles the depth is 6 to 8 feet. South of this point, the country undergoes a gradual change. The surface becomes more broken by the low ridges of rock and sand, and the wide, continuous and uninterrupted areas of muskeg and moss disappear, giving place to smaller isolated areas in purely local depressions. This region constitutes the transition between the typical country of the coastal plain and the clay belt extending north from the line of the Transcontinental Railway.

Referring to this strip of country examined, lying in the coastal plain, and indicated on Map No. 3 in red, the approximate length north and south is 70 miles, the width east and west about 13 miles and the contained area 850 sq. miles. As already suggested, I believe that conditions which apply here will be found to apply generally to very much larger areas, especially towards the West. Of this 850 sq. miles examined, 800 miles, or over 90 per cent., consists of what is apparently a good quality of clay soil, well adapted for agriculture. Of this 800 sq. miles, 65 per cent. is covered with from 3 to 5 feet of moss and muck, and the balance has 4 to 6 feet of moss and muck. This estimate does not, however, include very considerable areas of land immediately adjacent to Creeks and Rivers, which are to a varying extent affected by drainage and are consequently free from deposits of muck and moss. As such strips vary widely and are from 100 to 2,000 feet in width, no attempt has been made to determine even approximately these very considerable areas.

NOTE.—The area to which these figures apply, lies, as stated, in the coastal plain, and is outlined on Map No. 3, in red. South of this, and lying both to the north and south of the Archaen Boundary, is the transition area referred to. Some 600 odd square miles was included by the traverses in this transition section, of which area probably 75 per cent., or 450 square miles, is unsuited to agriculture, owing to deposits of sand. The explanation of these sandy tracts, which constitute much of the transition area, is as follows: Originally in the great glacial lake, (see Appendix No. 3), deposits of clay were laid down, and should be found generally underlying the whole country. As the waters of this lake, which later became an inland sea, retreated, the action of the water was exactly as we have it in the case of any large body of water to-day. Where the shore line consists of hard rocks containing a large percentage of quartz, we find the waves wearing away the rocks to form sand beaches. A natural concentration or classification takes place and the lighter quartz sand remains on top. Similarly is the case of the glacial lake, its retreating waters beating against the projecting knobs and ridges of the Archaen rocks established sand beaches from the wearing away of these rocks. I have referred to this somewhat at length, because I believe that all along this encampment of the Archaen rocks, east and west, will be found a similar belt of more or less sandy waste land. We thus have the three great belts—(1) The Coastal Plain, north of the Archaen Boundary, which is practically all good clay soil; (2) The region of change or transition between the coastal plain and the upper plateau, and of which a large proportion is waste land; (3) The upper plateau, comprising the wide clay belt, through which the Trancontinental Railway runs.

Evidence of the apparently good quality of the soil is seen in the character of the growth on such areas as have been affected by partial or complete drainage. Thus, it is no uncommon thing to find anywhere along banks of creeks and rivers, where fire has not run, spruce, balm-of-gilead, and birch up to 20 in. to 24 in. in diameter, with raspberry bushes, grasses, golden-rod, daisies, with other common field plants, and often a profusion of luxuriant ferns in the more sheltered places.

Regarding the climate of the coastal plain, there is already ample data available to demonstrate its adaptability to wide range of agricultural products. In Appendix "A" will be found tables from Meteorological records by R. F. Stupart, Director of the Dominion Meteorological Service, and from which the following extract is taken:—

Mean Average Temperature in Various Months.

Station.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Summer Mean.
Edmonton	7.0	9.8	22.3	41.0	51.5	57.1	61.2	59.1	50.0	41.5	24.0	16.6	59.1
Moose Factory	4.0	1.2	10.0	27.3	41.6	55.2	61.6	58.6	51.7	40.4	21.0	3.3	58.5

NOTE.—Mr. Stupart, who has, I believe, devoted considerable time to the question of mean summer temperatures as applied to the raising of wheat, considers a mean summer temperature of 57.5 to be a safe limit up to which wheat can be grown. The present mean temperature, given in the above table, namely 58.5°, would, doubtless, be modified as a result of drainage.

It can scarcely be said that the policy of the Hudson's Bay Company has been to encourage agriculture at their posts in Northern Ontario, and attempts at cultivating the soil appear to have been largely of the hit or miss order. However, at New Post, 100 miles south of Moose Factory, I was informed that there have been raised successfully all the common garden vegetables, including potatoes, carrots, cucumbers, radishes, etc., and even Indian corn and tomatoes. The

Moose Factory.

Mr. McLeod and Family, New Post, June, 1911.

agent in charge also stated that he had grown pumpkins up to 18 lb. weight, marrow squash 2 ft. in length, and that melon vines had been cut by an early frost after the melons had attained a diameter of 5 in. On June 18th of this year a fine crop of clover and timothy hay 3 ft. high covered an area of several acres, although the ground had not been cultivated in any way for several years. Similarly, at Moose Factory, all the common garden vegetables do well, and bags of new potatoes of good quality, dug on August 10th of this year, were purchased from the Hudson's Bay Co. Nothing definite could be learned here regarding attempts to cultivate cereals, but on the 8th of August there was at Moose Factory a very fine field of barley ready to cut. Light summer frosts have occurred in the past at intervals, as is but natural amid such a vast area of undrained land. Such frosts are said to be of rare occurrence, and would doubtless disappear with the clearing up of the land. It is an established fact that early and late frosts are now unknown in many parts of the West, where years ago there was frost in every month of the year.

Finally, to anyone who has at all considered the matter, the question of latitude, as applied agriculturally to the coastal plain of James Bay, can be of no real significance. At the following points not only have all the ordinary root crops and garden vegetables been successfully grown, but even wheat has been ripened:—

Name of place.	Latitude.
Fort Simpson	61°48′
Fort Providence	61°24′
Fort Heard	60°15′
Fort Vermilion	58°24′
Fort Chipewyan	58°42′
Fort McMurray	56°42′
Lesser Slave Lake	55°36′
Dunvegan	55°55′
Fort St. John	56°15′
Hudson's Hope	56°00′
Norway House	54°00′
Nelson House	55°48′

NOTE.—The Province of Tobolsk, in Siberia, lies between latitudes 55 and 70. In 1907 the Agricultural products were:—

Wheat	11,779,000 bush.
Rye	4,344,000 bush.
Barley	829,000 bush.
Oats	13,818,000 bush.

There was also exported 17,711,446 lbs. of butter. The population of the province is 1,656,700.

Compared with the above, the latitude of Moose Factory is 51 deg. 18 min., and of New Post 50 deg. 80 min. The latitude of Edmonton is 53 deg. 33 min. Even should the climate be somewhat colder in winter, this fact will not debar people from settling there if the agricultural possibilities are established. As has been remarked, "Things don't grow in the winter, anyway."

(2) Resources Depending on Timber.

The explored area on the coastal plain, as indicated on Map No. 3, that is, for quite 90 miles south of James Bay, is decidedly not a timber country. As a producer of saw logs and of pulpwood, practically the only areas are immediately adjoining creeks and rivers. On Map No. 3 are indicated a few of the points at which estimates of the timber growth were made.

There are several reasons why it is difficult to estimate the timber growth in the belt of land under consideration north of the latitude of New Post:—

(1) There has been a series of fires over quite 60 per cent. of the country, and these fires have resulted in a series of second growths. The difficulty is that these second growths are of various ages, some dating back to 10, some 20, some 50, and some 75 years. Apart from this, only remnants of the original forest remain.

(2) The edges of these several burnt areas are naturally exceedingly irregular. These areas may vary from a width of 100 feet to 1,000 feet in a very short distance.

(3) The small tributary streams along which a great deal of the available timber is to be found have never been mapped and their extent is, therefore, not known.

Hence, I have formed the following conclusions.—

(1) That a large number of piles (all spruce) and sufficient for all railroad and terminal purposes can be secured more or less conveniently to the work, while there is a good deal of scattered tie timber. Its scattered character makes it difficult to say whether there would be a sufficient supply to allow 2,600 ties to the mile, but certainly a large number of ties can be had.

(2) That the country can never hope to export timber products but can expect sufficient for local uses for some time to come.

(3) That considering the manner in which timber occurs for the most part, namely, in long narrow belts, permanent sawmills can never be used. Portable mills, situated near a line of railway are the only means of handling the small cuts available. Small sawmills operated by the Revillon Co. and by the Hudson's Bay Co., at Moose Factory, have for a number of years had no difficulty in obtaining all the logs they require—about 1,000 logs per annum per mill.

(4) The large single area of pulpwood of good quality and growth was estimated at 1,000 acres. Generally the areas seen appeared to be considerably smaller than this.

(5) There is in the burnt areas sufficient fire killed wood to supply fire wood for settlers for several years.

(3.) Resources Depending for Their Value or Economic Minerals.

From time to time various reports have been made concerning the value of economic minerals occurring to the north of the Archaen Boundary. In this connection the following are the more important minerals that have been mentioned:

1. Gypsum.
2. Lignite.
3. Peat.
4. Oil.
5. Bituminous Shales (so-called).
6. Iron.

1. Gypsum: It is not necessary to here refer to the commercial and mining conditions which at present govern the production of gypsum and its various derivatives in Canada and the United States. From considerations of possible markets and the adaptability of the deposits to development, it can be easily demonstrated that the future of the gypsum deposits on the Moose River, apart from a limited local consumption, is a problem for many years to come.

2. Lignite: Occurrences of lignite in Northern Ontario have, I believe, been mentioned in reports from time ot time, and for this reason they are here referred to Having personally examined nearly all the deposits of lignite in the Moose River basin, I find it hard to see how these deposits can be seriously

considered as of economic value. The insignificant size and irregularity of the seams, the inferior quality of the coal itself, and the utter impractibility of mining the deposits, are some of the reasons that would tend to discourage development in this direction.

3. Peat: Opinion is still somewhat divided as to the probable future of peat as a potential factor in the mineral resources of Canada. It will doubtless continue to be so until the final results of the elaborate experiments at present being conducted by the Department of Mines at their testing plant and laboratory at Ottawa, and at the various Government peat bogs, are announced. It may then be time to consider the possible value of the reported peat bogs of the coastal plain, a value which, so far as I can learn, still remains to be demonstrated by analyses and by soundings or other measurements.

4. Oil: So far as is ascertainable certain oxides derived from decaying vegetable matter constitute the rather uncertain evidence upon which, to date, the petroliferous future of the region depends. As a matter of fact, there is at present no direct evidence of the presence of petroleum in the great Devonian areas of the coastal plain. What is, however, of still greater consequence, in the absence of any indications of an impervious stratum or cap, and the probability that such a stratum or cap, if it ever existed, has long since been eroded away, along with a considerable thickness of the Devonian formation itself.

5. Bituminous Shales: A description of these Devonian shales, which outcrop extensively along the Abitibi River above the mouth of the Little Abitibi, and which have been referred to as oil shales, will be found in the detailed notes submitted herewith. Samples for analysis are at present in the hands of the Department of Mines at Ottawa, but the quantities of oil and of ammonia contained in these shales will, I think, be found to be of negligible value.

6. Iron: Regarding the iron on the Mettagami, Mr. Baker has, I believe, already reported. While I have not as yet seen his report on these desposits, it may possibly be regarded as a significant fact that two of the men largely interested in these mineral claims have informed me that they are allowing their stakings to lapse.

Clay:—In such an enormous area of clay deposits, certain varieties of clay of considerable economic value, as being adapted to special uses, may possibly be found. Considering the geological origin of these clays, however, (see Appendix No. 3) one would expect a great uniformity through the whole of the Moose River Basin. Mr. Heinrich Rees, of Cornell University, and Mr. Jos. Keele, of the Canadian Geological Survey, are at present investigating the clay deposits of the Dominion. Their opinion in regard to this matter would doubtless be of interest as well as of value.

In conclusion, then, and considered as a primary incentive to the opening up of the area known as the Coastal Plain, the mineral prospects, as at present recognized, can scarcely be described as bright. On the other hand, it must be remembered that, apart from a very general sort of exploration, no actual prospecting has as yet been done. Moreover, it is more than probable that, sooner or later, some at least of the deposits referred to above will take their place as productive assets of this region.

Hay Meadow, Ship Sands.

Hay Stacks—Ship Sands, Moose Factory.

Table I.

Showing the mean average temperature in the various months at stations in Northern and Western Canada.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Summer Mean.
Fort Macleod	20.3	18.5	25.1	42.6	50.6	57.3	64.5	62.8	53.0	42.5	28.7	27.3	61.5
Calgary	12.3	13.5	23.9	40.0	49.1	55.3	60.6	57.5	50.2	41.9	25.6	20.4	57.8
Edmonton	7.0	9.8	22.3	41.0	51.5	57.1	61.2	59.1	50.0	41.5	24.0	16.6	59.1
Medicine Hat	11.3	12.7	25.6	44.9	53.0	61.3	68.1	66.4	55.8	45.6	28.2	20.4	65.3
Prince Albert	4.1	2.1	12.3	37.1	49.3	57.5	61.8	59.0	49.0	38.1	17.6	5.0	59.4
Qu'Appelle	0.3	0.8	14.6	38.2	50.2	59.3	64.0	61.7	51.9	40.6	21.1	9.5	61.7
Winnipeg	3.8	1.5	14.9	38.9	51.7	62.0	65.8	62.7	53.7	40.9	21.0	5.4	63.5
Dunvegan	10.2	4.4	10.0	38.2	50.5	56.5	61.3	57.4	46.3	33.1	18.6	1.6	58.4
Chipewyan	12.0	6.8	5.1	28.5	44.5	54.0	61.5	58.2	45.2	33.7	11.1	2.2	57.9
Norway House	9.4	6.8	7.6	32.1	46.5	55.4	62.4	59.7	49.0	35.8	16.6	2.1	59.2
Fort Hope	6.6	4.8	7.7	31.0	44.2	54.4	61.3	59.1	48.4	36.5	19.2	0.6	58.3
Moose Factory	4.0	1.2	10.0	27.3	41.6	55.2	61.6	58.6	51.7	40.4	21.0	3.3	58.5
York Factory	18.8	14.0	0.2	21.5	34.6	48.0	55.7	53.4	43.7	28.4	10.5	10.1	52.4
Fort Churchill	20.2	15.6	3.0	22.4	32.5	42.8	55.5	52.6	42.3	27.3	7.9	9.0	50.5
Hay River	16.8	10.9	1.5	26.1	41.2	51.3	61.5	58.0	45.5	31.7	7.2	6.0	56.9
Fort Simpson	19.2	17.9	3.2	28.2	43.0	55.5	60.2	55.7	43.5	24.8	0.7	11.2	57.0
Fort Good Hope	28.0	21.8	8.7	16.9	36.7	55.1	59.1	53.5	37.7	17.0	10.9	21.1	55.9
Dawson City	23.6	12.1	5.4	27.7	45.5	57.5	60.4	54.5	41.6	24.1	1.5	10.3	57.5
Peel River	27.5	23.3	7.4	7.7	28.8	51.0	57.7	53.8	36.3	13.9	11.4	17.7	54.2
Herschell Island	19.0	14.0	8.0	2.0	20.0	35.0	43.0	40.0	30.0	11.0	6.0	15.0	39.0
Haileybury	6.4	9.0	12.1	38.3	51.3	61.5	66.2	62.3	54.4	42.5	28.1	11.5	63.3
Abitibi	1.4	2.6	14.2	32.4	46.6	58.1	64.1	60.3	51.8	40.4	24.2	7.1	60.8

Table II.

The average mean highest temperature.

	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
Fort Macleod	31.4	29.8	38.5	56.6	64.4	70.9	80.2	78.0	65.6	57.1	39.0	36.9
Calgary	23.1	24.5	35.6	53.2	62.7	68.4	74.7	70.2	63.7	55.1	36.3	30.1
Edmonton	16.7	20.3	33.8	53.1	64.8	69.9	73.8	71.8	62.2	52.9	32.8	25.3
Medicine Hat	21.8	22.7	37.2	58.5	67.9	74.6	82.4	80.9	70.0	59.0	39.1	29.8
Prince Albert	7.5	10.1	25.6	50.2	63.3	70.5	74.5	72.3	61.4	49.3	26.9	15.7
Qu'Appelle	9.0	10.2	24.6	49.3	62.5	71.7	76.6	74.7	64.2	51.2	29.7	18.0
Winnipeg	6.8	10.2	26.2	50.6	65.0	74.4	77.8	75.4	65.9	51.5	30.1	16.4
Dunvegan	2.4	16.9	32.6	52.1	64.9	70.7	75.4	71.0	60.9	43.8	24.7	8.0
Chipewyan	3.5	4.9	15.1	39.4	53.8	64.6	71.0	68.1	53.0	40.1	17.9	10.3
Norway House	0.6	4.2	19.3	42.7	57.4	66.4	72.1	68.6	57.1	42.4	23.8	5.6
Fort Hope	4.0	6.9	20.4	43.2	56.2	67.3	73.3	70.3	58.3	44.7	26.2	8.5
Moose Factory	7.2	11.4	23.2	37.7	51.4	66.6	72.4	69.0	61.0	47.8	28.1	13.2
York Factory												
Fort Churchill	12.3	8.5	4.1	31.6	40.0	54.8	66.8	61.8	50.7	33.1	12.4	4.3
Hay River	8.1	0.1	15.1	38.4	52.7	63.0	73.5	69.7	56.5	39.7	14.6	1.5
Fort Simpson	11.2	7.7	9.5	39.2	53.4	66.1	71.4	66.2	52.7	31.0	6.0	4.1
Fort Good Hope												
Dawson City	16.7	4.3	17.5	39.9	57.1	70.5	72.7	66.1	50.6	30.9	4.5	4.5
Peel River	18.6	13.9	4.1	19.4	37.4	60.8	68.0	64.0	44.1	20.8	4.4	10.5
Herschell Island												
Haileybury	17.6	20.4	31.4	49.8	63.2	73.3	77.0	73.1	65.1	51.3	35.0	20.6
Abitibi	13.1	15.2	26.1	41.8	55.6	66.9	72.5	68.6	59.3	47.3	30.7	16.3

Table III.

The average mean lowest temperature.

—	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Fort Macleod	9.1	7.2	11.8	28.7	36.8	43.7	48.8	47.7	40.4	31.9	18.3	17.7
Calgary	1.6	2.4	12.2	26.8	35.5	42.2	46.5	44.8	36.7	28.6	14.8	10.6
Edmonton	2.7	0.6	10.9	29.1	38.2	44.3	48.6	46.5	37.8	30.1	15.2	7.9
Medicine Hat	0.9	2.7	14.0	31.2	41.2	48.0	53.9	51.8	41.7	32.3	17.2	10.9
Prince Albert	15.7	14.2	0.9	24.0	35.4	44.4	49.1	45.6	36.5	26.9	8.2	5.6
Qu'Appelle	9.6	8.7	4.6	27.0	37.9	46.8	51.4	48.7	39.6	30.0	12.5	1.0
Winnipeg	14.5	13.1	3.6	27.2	38.4	49.6	53.9	50.0	41.5	30.3	11.8	5.6
Dunvegan	22.0	8.8	7.9	24.6	34.0	41.7	47.2	45.5	34.5	23.6	9.7	10.7
Chipewyan	20.4	18.7	5.0	17.6	35.1	43.3	51.9	48.2	37.3	27.3	4.2	5.9
Norway House	19.4	17.9	4.0	21.5	35.5	44.4	52.7	50.7	40.9	29.2	9.4	10.7
Fort Hope	17.2	16.5	4.9	18.7	32.2	41.4	49.4	47.9	38.4	28.3	12.2	9.8
Moose Factory	15.2	13.7	3.2	17.0	31.8	43.9	.8	48.2	42.3	32.9	14.0	6.5
York Factory	....	....	....	....	....	....	....	....	....	....	....	....
Fort Churchill	....	....	....	....	....	....	....	....	....	....	....	....
Hay River	25.6	21.7	12.2	13.8	29.7	39.6	49.5	46.4	37.5	23.7	0.2	13.4
Fort Simpson	27.3	28.1	16.0	17.1	32.5	44.9	49.1	45.4	34.4	18.6	7.4	18.4
Fort Good Hope	....	....	....	....	....	....	....	....	....	....	....	....
Dawson City	30.5	20.0	6.7	15.6	32.9	45.2	48.1	42.9	32.5	15.9	7.4	16.4
Peel River	34.9	32.6	19.2	6.9	20.1	40.7	48.0	42.2	28.3	7.7	17.4	24.9
Herschell Island	....	....	....	....	....	....	....	....	....	....	....	....
Haileybury	4.7	2.3	7.2	26.9	39.5	49.7	55.3	51.5	43.8	33.6	21.2	2.4
Abitibi	20.3	10.0	2.2	23.0	37.6	49.3	55.7	52.0	44.4	33.5	17.8	2.1

Table IV.

The absolutely highest temperature in each of the various months, on record at the Meteorological Office.

—	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
Fort Macleod	58	62	82	83	89	98	102	97	89	85	79	77
Calgary	59	59	75	78	90	94	95	95	89	85	70	60
Edmonton	57	62	72	84	90	94	94	90	86	82	74	56
Medicine Hat	62	64	75	94	94	107	108	103	93	93	78	68
Prince Albert	53	52	62	84	90	96	93	94	87	79	66	58
Qu'Appelle	44	50	65	84	92	100	100	100	91	85	73	49
Winnipeg	40	46	62	90	94	101	96	103	99	85	60	45
Dunvegan	48	52	76	75	94	87	93	90	78	70	59	46
Chipewyan	45	46	47	69	83	90	93	89	79	66	56	49
Norway House	39	36	50	75	91	89	88	90	80	75	57	38
Fort Hope	38	42	55	71	87	92	93	99	89	83	56	38
Moose Factory	40	42	57	72	88	93	97	87	91	81	62	38
York Factory	30	27	45	72	80	89	91	88	77	60	51	32
Fort Churchill	16	29	40	61	80	82	88	82	82	60	45	39
Hay River	47	48	58	74	85	95	96	90	89	72	51	39
Fort Simpson	32	34	54	62	84	82	87	82	78	60	41	45
Fort Good Hope	26	32	45	63	80	82	86	81	66	49	45	24
Dawson City	21	29	52	67	85	90	95	86	79	62	46	38
Red River	37	35	46	52	74	85	89	82	73	46	35	45
Herschell Island	36	35	38	33	53	65	69	64	55	33	26	28
Haileybury	48	47	71	79	93	89	99	90	91	80	67	47
Abitibi	42	46	62	70	77	94	93	86	87	76	68	48

Table V.

The absolutely lowest temperature in each of the various months.

—	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Fort Macleod	41	49	33	10	5	30	37	29	20	4	38	43
Calgary	48	49	34	14	12	26	31	28	15	7	31	39
Edmonton	57	57	40	10	11	25	33	28	12	10	44	45
Medicine Hat	51	51	38	16	12	31	36	32	17	10	36	50
Prince Albert	67	70	43	23	13	26	33	22	14	8	35	57
Qu'Appelle	48	55	45	24	10	25	36	27	10	12	30	41
Winnipeg	46	47	37	13	14	21	36	30	17	3	33	42
Dunvegan	62	55	52	27	12	17	31	23	20	6	28	47
Chipewyan	55	56	41	22	3	24	26	25	13	2	33	48
Norway House	63	54	47	11	12	26	32	30	14	2	35	42
Fort Hope	54	52	47	27	1	25	30	27	16	4	38	47
Moose Factory	45	44	45	21	7	23	31	34	27	12	20	41
York Factory	56	60	51	21	0	23	30	28	6	16	40	60
Fort Churchill	57	52	52	28	10	……	……	……	15	17	38	45
Hay River	62	59	48	31	10	25	35	26	4	10	38	47
Fort Simpson	62	54	50	13	9	27	31	24	11	8	41	49
Fort Good Hope	72	67	54	31	11	24	34	27	1	35	52	60
Dawson City	68	62	54	38	5	27	35	20	1	10	48	50
Peel River	68	61	56	48	10	26	32	25	5	26	50	59
Herschell Island	52	51	40	29	11	12	27	26	8	16	32	39
Haileybury	40	38	34	1	17	28	36	30	24	14	17	34
Abitibi	46	44	42	9	9	28	37	34	27	12	16	45

Table VI.

Showing the total average annual precipitation (rain and melted snow).

—	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
Fort Macleod	0.44	0.41	0.75	0.51	2.00	2.20	1.80	1.35	1.14	0.48	0.68	0.37	12.17
Calgary	0.47	0.62	0.76	0.63	2.24	2.96	2.88	2.59	1.32	0.49	0.78	0.62	17.36
Edmonton	0.65	0.73	0.68	0.88	1.88	2.83	3.47	2.04	1.48	0.66	0.61	0.73	16.64
Medicine Hat	0.63	0.68	0.69	0.66	1.80	2.69	2.09	1.56	1.16	0.54	0.87	0.55	13.92
Prince Albert	0.89	0.73	1.00	0.79	1.56	2.59	2.28	2.07	1.33	0.76	0.99	0.66	15.65
Qu'Appelle	0.61	0.85	0.89	1.15	1.98	3.45	2.64	1.75	1.42	0.98	0.87	0.66	17.45
Winnipeg	0.83	0.93	1.07	1.55	2.31	3.43	3.03	2.55	2.11	1.61	1.06	0.92	21.40
Dunvegan	1.49	1.00	1.58	0.58	1.91	2.92	1.44	2.56	1.35	1.43	1.13	0.99	18.68
Chipewyan	0.86	0.55	0.66	0.64	0.72	1.57	2.53	1.84	1.47	0.75	0.87	0.74	13.20
Norway House	0.78	0.70	1.01	0.84	1.24	2.40	3.33	2.42	2.27	0.77	1.10	0.88	17.66
Fort Hope	0.80	0.50	0.70	0.23	0.95	1.78	2.28	1.81	2.28	1.02	1.06	0.80	14.21
Moose Factory	1.02	0.62	1.43	1.13	2.40	2.47	2.52	3.03	2.95	1.97	1.55	1.14	22.23
York Factory	0.63	0.35	0.40	0.83	1.13	1.90	....	....	2.64	1.51	0.69	0.61	....
Fort Churchill	0.30	0.50	0.60	0.80	1.30	1.77	1.78	....	....	1.41	0.80	0.50	....
Hay River	....	....	....	....	....	....	....	....	....	....	....	....	....
Fort Simpson	0.70	0.50	0.60	0.70	3.00	2.08	1.89	1.40	1.00	1.30	1.10	1.20	15.47
Fort Good Hope	....	....	....	....	....	....	....	....	....	....	....	....	....
Dawson City	0.90	0.75	0.30	0.50	0.94	0.82	1.77	1.85	1.60	1.25	0.75	1.15	12.58
Red River	....	....	....	....	....	....	....	....	....	....	....	....	....
Herschell Island	....	....	....	....	....	....	....	....	....	....	....	....	....
Haileybury	2.17	1.99	2.29	1.74	2.08	3.42	3.80	2.81	3.51	2.83	2.29	2.37	32.30
Abitibi	1.67	1.15	2.65	1.11	2.73	2.95	2.39	2.56	2.01	2.92	2.16	2.13	26.43

APPENDIX No. 2.

NOTES ON A POSSIBLE RAILWAY ROUTE FROM COCHRANE TO JAMES BAY.

While I have for reference no reports on the subject of possible railroad routes from Cochrane to James Bay, I understand that in the past three alternatives have been mentioned. The first of these would, to a large extent, I believe, follow the shores of the Abitibi River itself. The second would lie to the east of the Abitibi River. The third would follow the ground lying between the Abitibi and the Mettagami.

Of the country to be traversed by such a line between the latitude of New Post and Cochrane, I can speak only from hearsay, and from what I have seen in reports of the Ontario Government Exploration of 1900. From these sources of information I gather that, for railway purposes, the grounds south of New Post and between the Abitibi and the Mettagami will be found, generally speaking, to differ not greatly from that lying to the north of New Liskeard. An island in the Frederick House River, at a point of a few miles south of its junction with the Abitibi, affords an easy crossing of that stream. Between the Lobstick and the Long Portage there is a change of elevation indicated on the maps as about 26 feet per mile. It is probable that a moderate amount of reconnaissance work would discover a route such as would negotiate this piece of ground successfully. Incidentally, and without having taking any actual measurements, the general elevation above the river of the country, immediately north of the Long Portage, appeared to be greater than that to the south of the Lobstick, a fact which may considerably affect the question of gradients between these two points.

These two features were the chief points observed in merely passing down the Frederick House and the Abitibi Rivers in a canoe. But of the area lying to the north of New Post I can speak with certainty. On the accompanying map, No. 3, are indicated all creeks, crossed by traverses in this area, as well as the depths of muskeg that will be met with. The secondary drainage depressions can be more easily crossed at a distance of 1½ to 2 miles from the river than at any point within ¼ mile of the shore. At a distance of 1½ to 2 miles inland none of these streams will require structures of any considerable size.

The following conclusions summarize conditions that will be found along approximately 135 miles of possible line between New Post and Ship Sands Island.

(1) That a line showing easy (Max. .5%) grades and curvature (Max. 3°) can be secured without difficulty.

(2) That apart from traffic considerations a "river" line should not be seriously considered. (See Foot Note.)

(3) That a scarcity and possibly an absence of ballast may be expected on the northern section for possibly a distance of 90 miles. More careful examination may to some extent modify this statement.

(4) That the crossing of the Moose River is the outstanding consideration, regarding which information is lacking.

(5) That in point of cost, a correct estimate may be had by comparing the route, mile for mile, with those parts of the main line and the Porcupine Branch of the T. & N. O. Ry. through similar country.

(6) That intermediate soundings in the muskeg between the ranges indicated may be interpolated with perfect safety.

In conclusion, it might be well in projecting a line to keep in view such reaches of the Abitibi or Mettagami Rivers as are adapted to navigation by small steamers. It should also be remembered that if the country south and west of James and Hudson Bays is ever opened up, such settlement will be to the west rather than to the east of the Abitibi River. Considering the apparently superior terminal accommodation to be had at the mouth of the Moose River, there seems little to justify a line to the east of the Abitibi. Such a line would either lead to Hannah Bay or would involve two additional river crossings (both over the Abitibi) in order to again reach the north shore of the Moose River.

NOTE.—All the way north from New Post, and for a considerable distance south of that point, there have been many slips in the clay banks, sometimes five or six to the mile—and some of them at considerable proportions. I have waded across the toe of some of these slides when at every step one sank above the knees in the greasy blue clay. The point of the whole matter is, however, this:—In nearly every instance where slides of this kind have occurred, the areas that have been displaced are at points at which bush fires have removed the retaining influence of timber and of sod. In the case of a cleared right of way, the resulting conditions can be easily imagined. In point of mileage a line following down midway between the Abitibi and the Mettagami, and thence along the north shore of the Moose River, to a point opposite Moose Factory, is approximately 116 miles in length. The corresponding length of a river line, scaled from a map of the Abitibi River, of 40 chains to the inch, is 117 miles

Potato Patch, Moose Factory.

Mr. Hally's House—Revillion Bros.

APPENDIX No. 3.

REFERENCE TO GEOLOGICAL HISTORY AS THROWING LIGHT ON PRESENT CONDITIONS OF COUNTRY LYING SOUTH AND WEST OF JAMES AND HUDSON BAYS.

The present geographical and topographical conditions as they exist to-day to the south and west of James and Hudson Bays may be attributed to the movement of ice during the glacial period which occurred hundreds of thousands of years ago. There is some difference of opinions regarding certain details, but there is no doubt that at least one, and possibly two, great glaciers at one time covered the whole of North Eastern Canada. One of these glaciers had its centre somewhere in the north of the Labrador Peninsula, and, moving in a south-westerly direction, swept the southern part of James and Hudson Bays and a part of Keewatin, finally stopping in the vicinity of the Nelson River and Lake Winnipeg. Then, before this glacier from the North-East began to retreat, another sheet of ice, having Northern Keewatin as its centre, at a point probably near Chesterfield inlet, moved southward along the face of the first glacier. As these glaciers, influenced by the gradual change in climate conditions, melted away, there formed along their southern face more or less extensive lakes. In these lakes there was deposited by gradual erosion and subsequent sedimentation, extending over a long period of time, a part at least of the great clay deposits of the coastal plain. The deposits laid down at this time were, however, probably for the most part of the nature of boulder clays.

As the southern face of the great ice sheet retreated still further north, the sea gradually invaded what had formerly been a vast fresh water lake. Thus, at one time the shores of what are now known as James and Hudson Bays extended much farther south and west than they do to-day, and it is probable that the break in the land surface, which at present marks not only the northern limit of the archean rocks, but also the southern limit of the coastal plain, at one time constituted the shores of these northern waters. The elevation of a line, drawn along the northern limit of the Archean formation, is some 500 feet above the present level of tide water, and to this extent have the waters of James and Hudson Bays retreated during a period probably not exceeding 10,000 years. It was during this period that the clays which to-day cover such a large part of the coastal plain were deposited, as the result of gradual erosion and sedimentation. Hence these clays must be regarded as a sea deposit.

Topographically, then, as well as geographically, this most northerly part of Ontario is comparatively "young," and, as is the case with all "young" countries, there has as yet not been time for a "mature" drainage system to be developed. The rivers have not as yet intrenched themselves deeply, their banks are steep and sharply defined, and, as a result, the effective drainage is limited to comparatively narrow areas along either shore. Ultimately, these abrupt banks will develop into wide, easy slopes, affording drainage for correspondingly long distances, but for the present artificial means must be adapted to supplement the defective drainage system.

APPENDIX No. 4.

SOME NOTES ON THE PRESENT RATE OF SETTLEMENT OF THE CANADIAN NORTH-WEST.

In a pamphlet published in January, 1909, by the Forest Service of the United States, certain statements were made which appear to be worthy of careful consideration. This pamphlet is entitled "The future use of land in the United States," and the conclusions arrived at, while applied to the United States, are also interesting as indicating what we in Canada may also expect.

The writer of the article points out that by 1950 the United States will have a population of 150,000,000 people, and this is considered a conservative estimate. Some estimates run as high as 200,000,000. It is further pointed out that, in order to provide for the necessities of such a population, that demand for land by Americans coming into Canada is going to increase at a rate that we little realize. I do not think it an extravagant opinion to express that all the agricultural land in Canada—and not only that in Western Canada—will be enhanced in value, and will be very considerably in demand long before 1950 by reason of this over-crowding in the United States. In this connection it is also of interest to consider the question of increase of American population. The census of 1900 showed an increase in the United States of fifteen times the population of 1800. The population of Europe scarcely doubled in that time. With respect to the growth we may look forward to in Canada, we should have a somewhat similar experience to that of the United States. We have their population to draw upon, while they draw their population from across the Atlantic. Their increase in population is nearly half the total increase, the figures being 31,000,000 by immigration and 35,000,000 by natural increase.

It is not within my province to take up the possible colonization of Northern Ontario. But, in conclusion, I would ask you to consider the following statistics with reference to the land in the provinces of Manitoba, Saskatchewan, and Alberta. Incidentally I may note that the northern boundary of Manitoba lies at present along the 53° of parallel, and those of Saskatchewan and Alberta along the 60th parallel. It is obvious then that north of the limits of these three provinces, little agricultural land need be looked for.

In 1911, the total areas surveyed into sections in these three provinces, all water covered lands deducted, was 143,295,555 acres. If road allowances, forest reserves and Indian reserves were added, the figure would be increased to 153,797,981 acres.

From the above total surveyed acreage we must deduct:—

Total area [illegible] homesteads, S.A.V. homesteads, pre-emption and purchased homesteads	55,611,520
Total area granted to Ry. Companies on account of land subsidies	31,864,074
Total area school land endowment	7,963,254
Total area granted H.B. Company	6,575,400
North-West half-breed scrip, and Military scrip and Manitoba swamp lands	11,952,053
	114,166,301

Thus the total amount of surveyed land in the north-west still open for homesteading is 29,129,254 acres. As to the remaining land areas still unsurveyed, a large proportion has not yet been explored except in a very partial way. But from what is now generally known of the character of this unsurveyed land, the area available for some form of agriculture, though of much less average value than the lands surveyed to date, may be given as follows:—

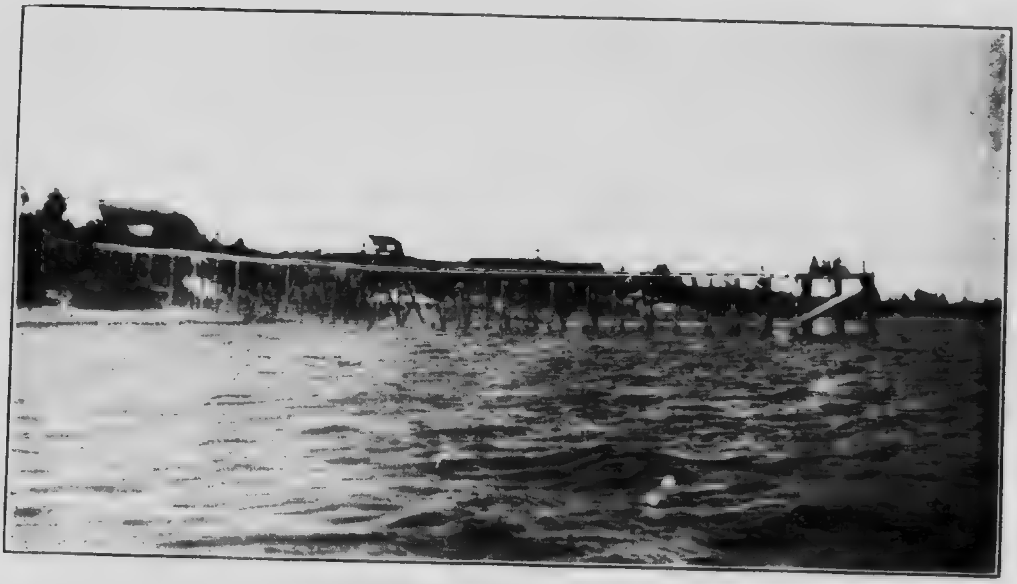
Manitoba	10,000,000	acres.
Saskatchewan	18,000,000	"
Alberta	60,000,000	"
Total	88,000,000	"
Territory to be added to Manitoba	10,000,000	"
Total	98,000,000	"

To arrive at the area of farming land, fairly equal in productiveness to the settled area, this figure of 98,000,000 has been cut in half by those competent to judge. We then have a grand total of available surveyed land and unsurveyed land in North-Western Canada made up as follows:—

Land surveyed still open for homesteading	29,129,284
Land unsurveyed and of more or less uncertain agricultural value, the greater part lying to the north of the 54th parallel	49,000,000
Total	78,129,284

During the period 1905-1910 the total number of homestead entries was 70,424, or an equivalent of 11,267,840 acres. During the period 1900-1905, the acreage taken up in this way was 5,520,480 acres. If now we only assume the same rate of increase that took place in 1905-1910 to apply to 1910-1915, the amount of free land for homesteading at the end of 1915 will be 17,861,414 acres, and before the end of 1923 all the land at present surveyed in the North-Western Provinces will have been taken up. If we take into consideration also the 49,000,000 acres still unsurveyed, and of which the greater part lies to the north of the 54th parallel, this period can be extended to about the end of 1945. As a matter of fact, the rate of increase in homesteading will probably increase much more rapidly from 1910-1920 than it did from 1905-1910, and it is thus likely that both the dates, 1923 and 1945, will have to be considerably modified. A very large percentage of the area referred to is, of course, not as yet under cultivation. My figures are merely intended to illustrate the outlook in the West from the point of view of the prospective homesteaders.

Butler's Island—Looking down stream. Revillion Bros.' schooner from Wabitgut.



Revillion Bros.' Wharf, Moose River.

APPENDIX No. 5.

NOTES ON THE NAVIGABILITY OF HUDSON BAY AND HUDSON BAY STRAIT.

Considering the possible harbor facilities at Moose River as merely constituting one feature of a general scheme of transportation, the following remarks may be of interest:

The geographical advantages of the so-called Hudson Bay route are at once obvious to anyone who has looked at a globe, and has realized that the Canadian North-West is not farther from England than is Eastern Canada. The distance from the mouth of the Moose River to Liverpool is 2,926 geographical miles, while the distance from Montreal to Liverpool is 2,760 miles. As a matter of fact, a route, say from Edmonton, or Saskatoon to Liverpool, *via* Winnipeg, Fort William and Montreal, really involves a detour equivalent to 1,000 miles, the greater part of which is rail haul.

For nearly 100 years the Hudson Bay route constituted the main highway between English ports and the Canadian North-West. It was largely through the advantages due to this fact that the Hudson Bay Company was enabled to win out in its competition with the North-West Trading Company, whose headquarters were of necessity in Montreal. Gradually, however, with the increase and improvement of transportation facilities in Canada and the Eastern States, the southern route first successfully competed with, and then on the completion of the C. P. R. having demonstrated its ability to handle all traffic offering from the West, it entirely superseded the Hudson Bay route. But of recent years the capacity of existing lines of transportation has become less and less able to handle the exports and imports of the West, and it has been even claimed that not more than 20 per cent. of the Western wheat crop can leave Fort William before the close of navigation. Moreover, during the harvest season, with the Westward traffic more or less demoralized, merchants complain of the difficulty in getting in their stocks for the fall trade. An answer to the question regarding the practicability of the Hudson Bay route has thus in recent years become more and more pressing.

So far as Hudson Bay itself is concerned, there is no question but that its waters are safe for navigation for quite six months of the year, or even longer. As a matter of fact, the real difficulty lies, not in the Bay, but in the Strait itself. With the object of attempting to demonstrate what may be expected in regard to the open period of navigation, several expeditions have at various times been despatched north in an endeavor to ascertain the true conditions prevailing in Hudson Strait. These expeditions arrived off the entrance of the Hudson Strait early in the season, and at the first opportunity pushed through to Hudson Bay. They then returned eastward to the Atlantic, repeating these trips east and west, until compelled by ice conditions to consider the route as no longer practicable.

Hudson Strait has a length of 480 miles from east to west. It has a practicable channel at least 35 miles wide, with from 50 to 200 fathoms of water; thus, there is no danger from stranding on the shores, and, moreover, a number of safe harbors exist, both on the north and south sides of these straits. In short, if situated in more southern latitudes, the route would be considered an ideal one for the navigator.

Stoney Point, Moose Factory to Hannah Bay.

Lunch—Ship Sands.

The Hudson Strait may be said never to freeze solid, although its waters are unnavigable for ordinary ships during spring and winter months owing to great sheets of heavy ice moving backwards and forwards under the influence of tides and currents. It is probable that a specially constructed ship might navigate Hudson Strait at any period of the year, although in the winter and spring, for at least seven months, such a voyage would be long and difficult. Ice attains a maximum thickness of six feet, but, when "rafted" sheet on sheet, it may have a total thickness of 25 feet. Ice does not begin to melt until well on in June, and is not sufficiently melted for safe navigation with ordinary steamers until the middle of July. In 1903 and 1904, Mr. A. P. Low, commanding the C.G.S. "Arctic," carefully investigated conditions affecting opening and closing dates for navigation, and the results of his work are summarized as follows:

"The period of safe navigation for ordinary iron ships through Hudson Straits and across Hudson Bay to Churchill may be taken to extend from the 20th of July to the 1st of November. This period might be extended without much risk by a week in the beginning of the season and perhaps by two weeks at the close."

Chief navigable streams draining area between Cochrane and Quebec boundary.

Name of river.	Navigable length.	No. of portages.	Where emptying.	Total miles.	Total portages.
Abitibi					
Moose River	340	15	James Bay		
Harricanaw	250	11	James Bay	490	26

Minor tributary rivers, navigable for 20-50 miles in same areas as above.

Circle River	20	Portages not indicated on maps.	L. Abitibi		
Law Bush	30		"		
Mishougo	40		into Abitibi R.		
Sucker	45		" " "		
French	75		" Moose R.		
Little Abitibi	80		" Abitibi R.		
West River	55		James Bay	345	

Chief navigable streams between Cochrane and Manitoba boundary.

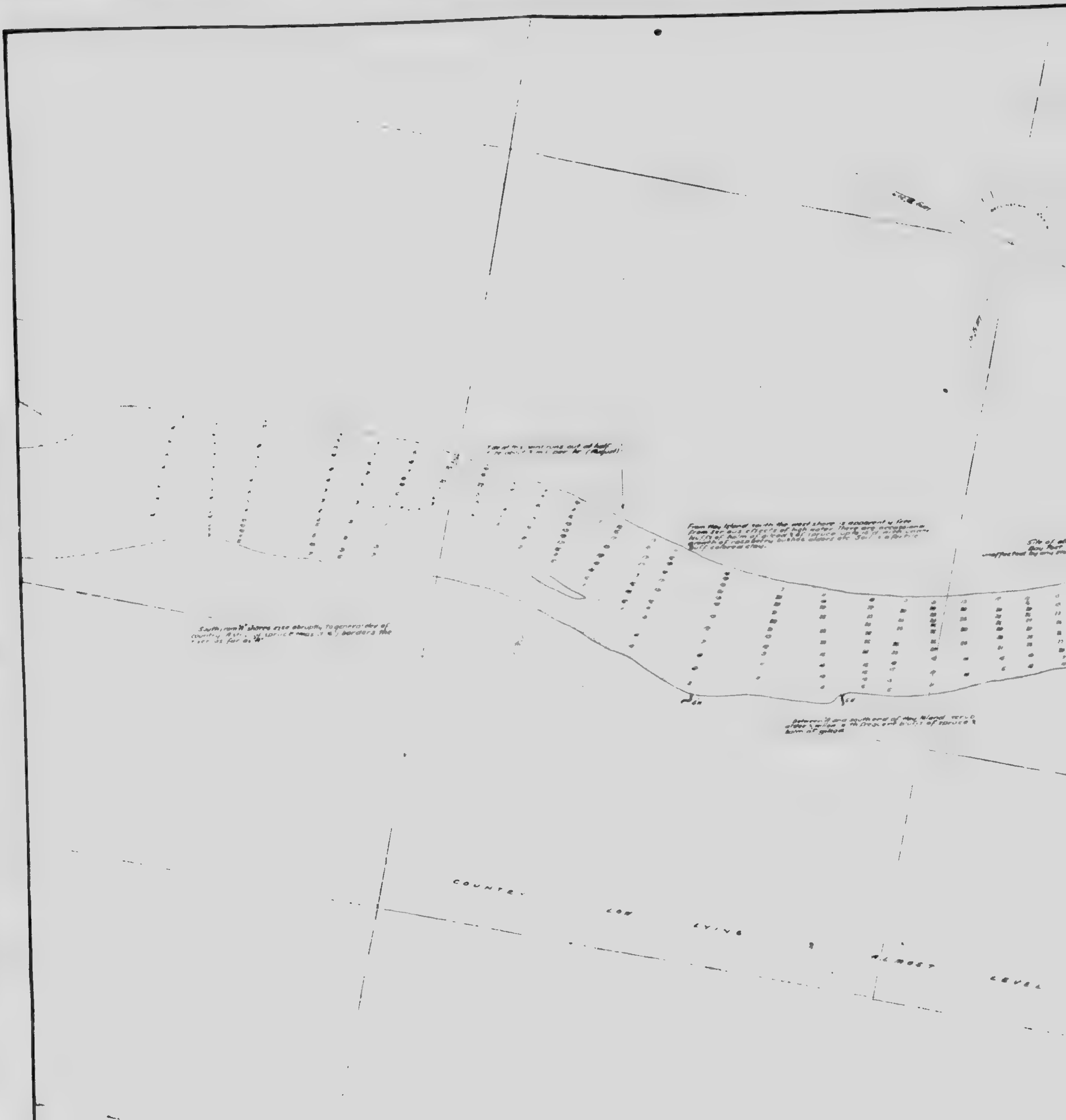
Frederickhouse R.	50	6	Into Abitibi		
Mettagami	280	13	" Moose		
Ground Hog	125	3	" Mettagami		
Kapuskasing	90	4	" "		
Opazatika	115	16 (?)	" Missainibi		
Missainibi	265	14	" Moose		
Kabinokagami	175	13	" Kenogami R.		
Oba R	50		" Kabinokagami		
Nagagami	105	17	" Kenogami		
Pagwachuan	120	7	" Kenogami		
Kenogami	340	14	" Albany		
Drowning R.	160	14	" Kenogami		
Little Current R. and Kawaakagama	190	29	" Kenogami		
Ogoki	230	15			
English	200	7	" Winnipeg R.		
Wabigoon	90	3	" English R.		
Winnipeg R.	50	1			
Albany	535	not marked	" James Bay	3,040	176

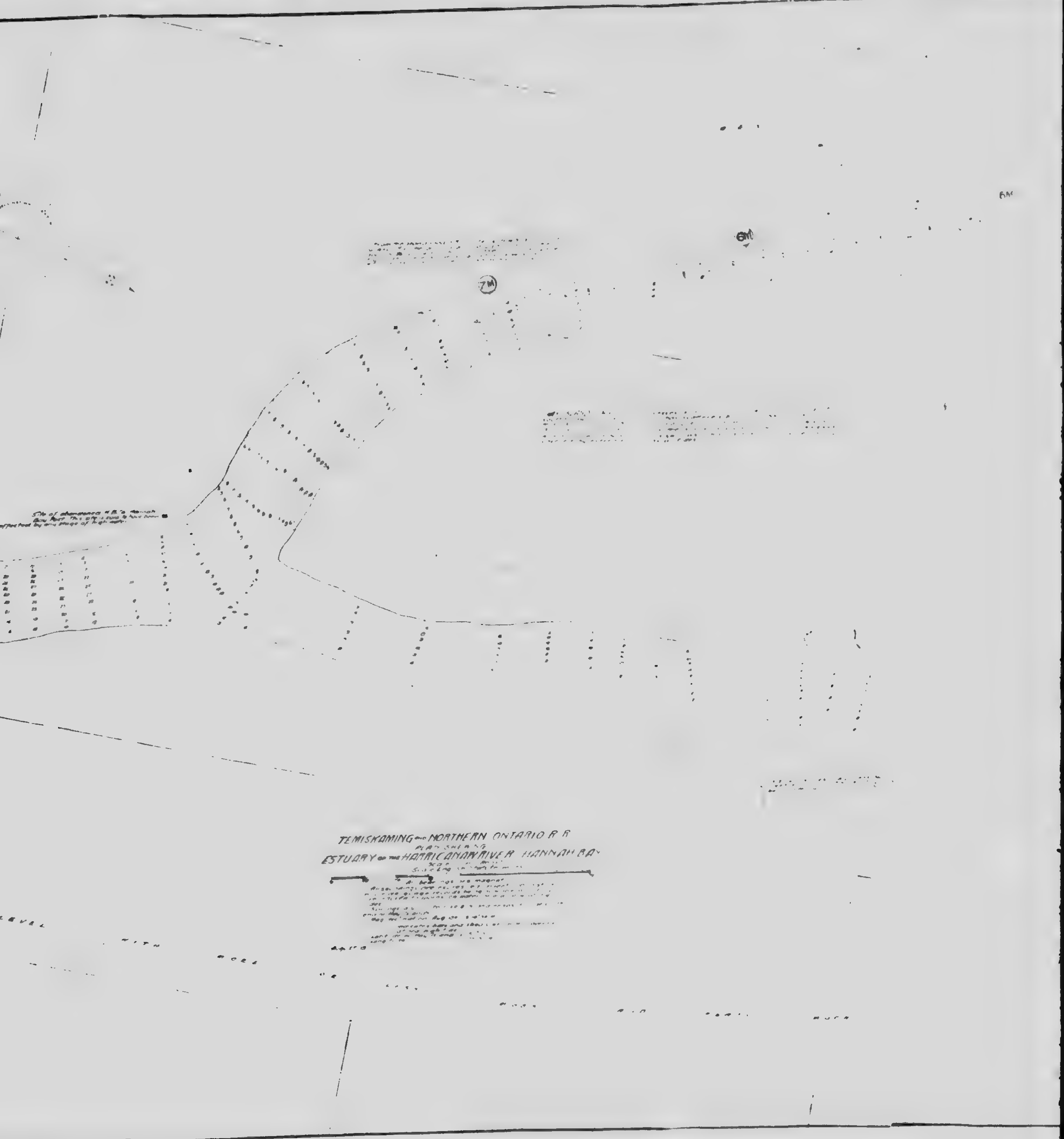
Minor navigable streams in same area as above.

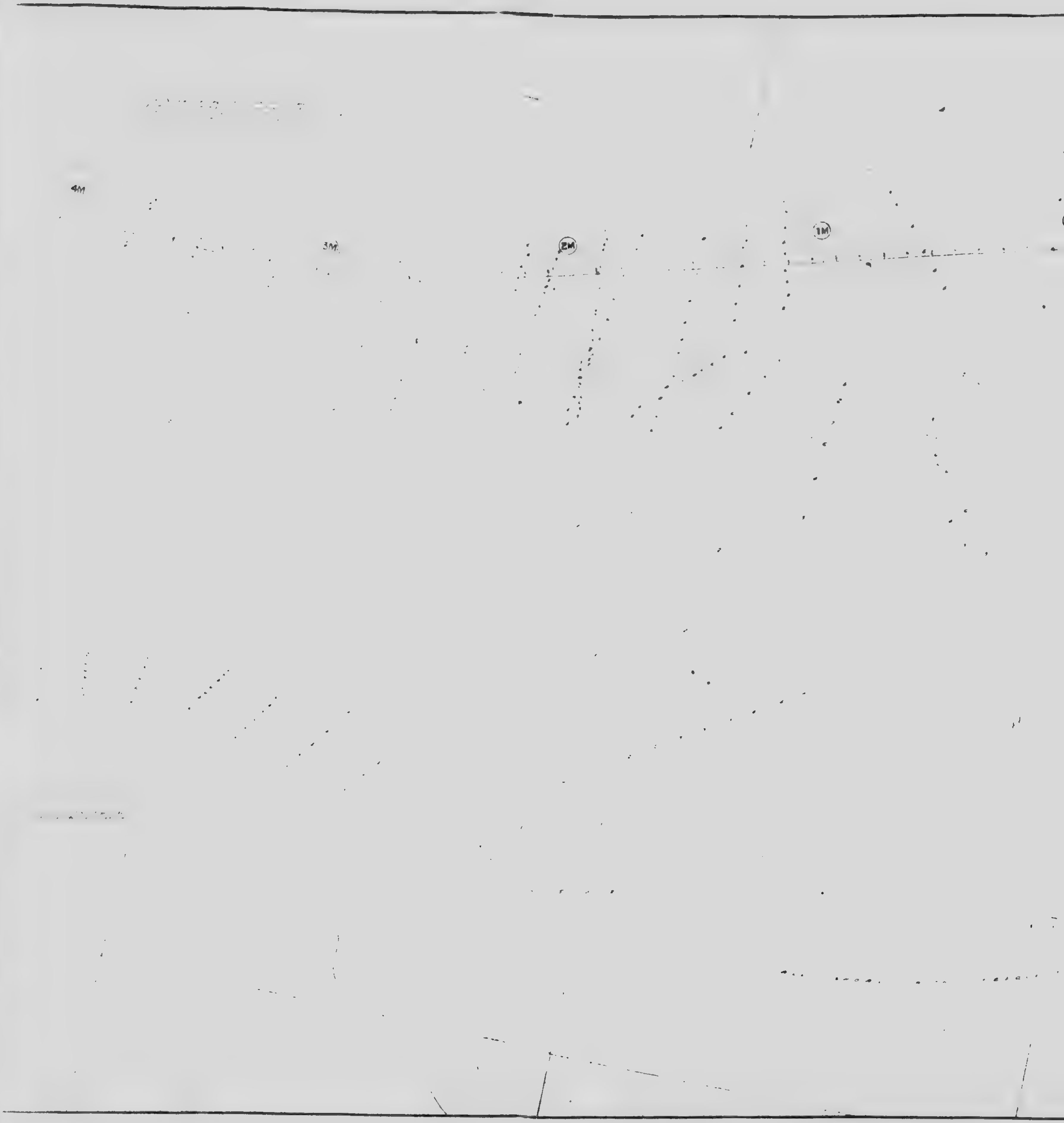
Poplar Rapids	30	4			
Driftwood R.	50	2			
Mattawishkwia	50	1			
Kapitongra	75	not given			
Pallinade R.					
Pushagoon					
Root R. Route	75	23		380	30

SUMMARY OF ABOVE.

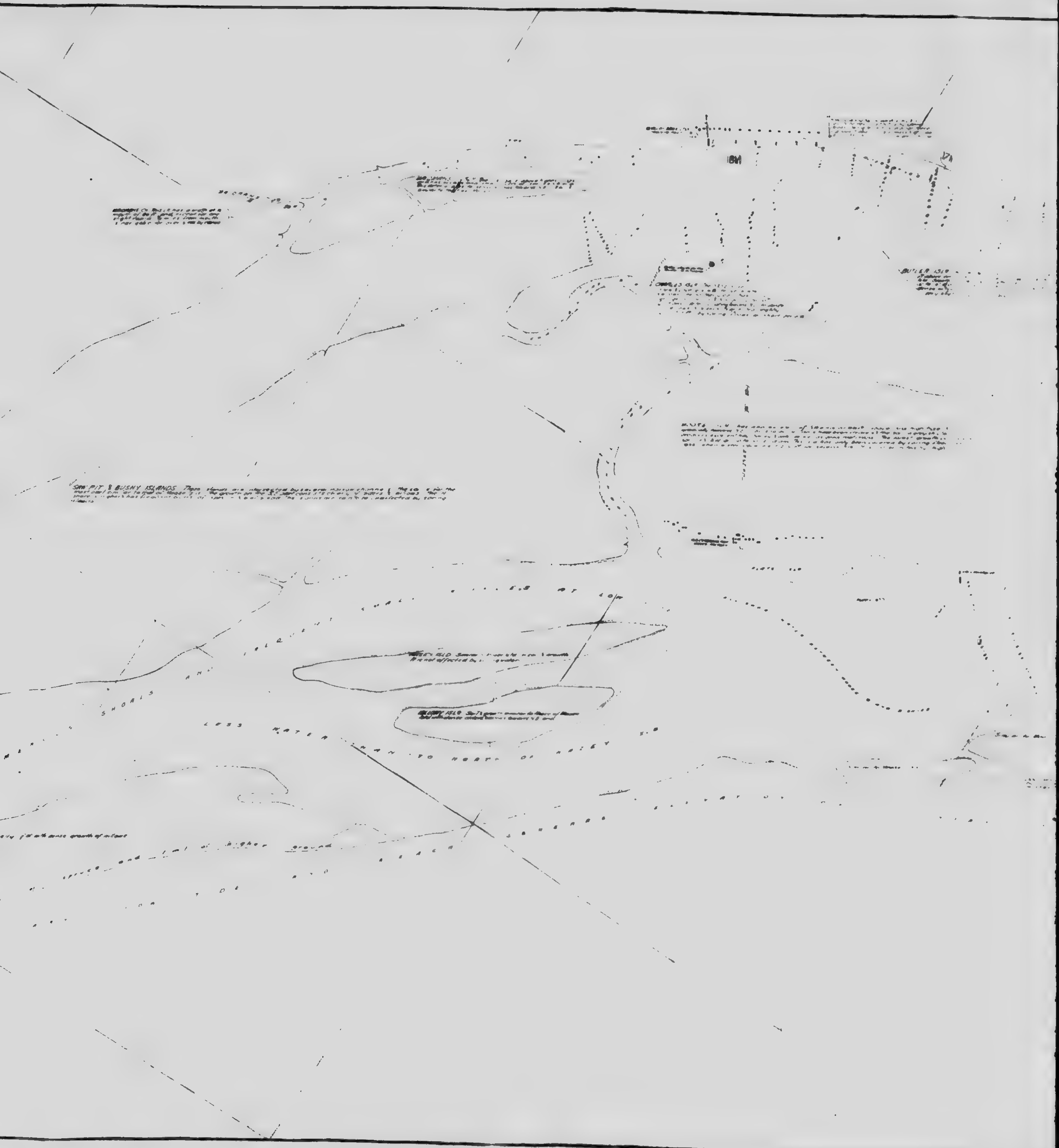
Total miles navigable streams east of Cochrane—835 miles, with 26 portages.
" " " " west " " —3,320 miles, with 206 portages.
" " " Quebec-Manitoba—4,165 miles, with 232 portages.

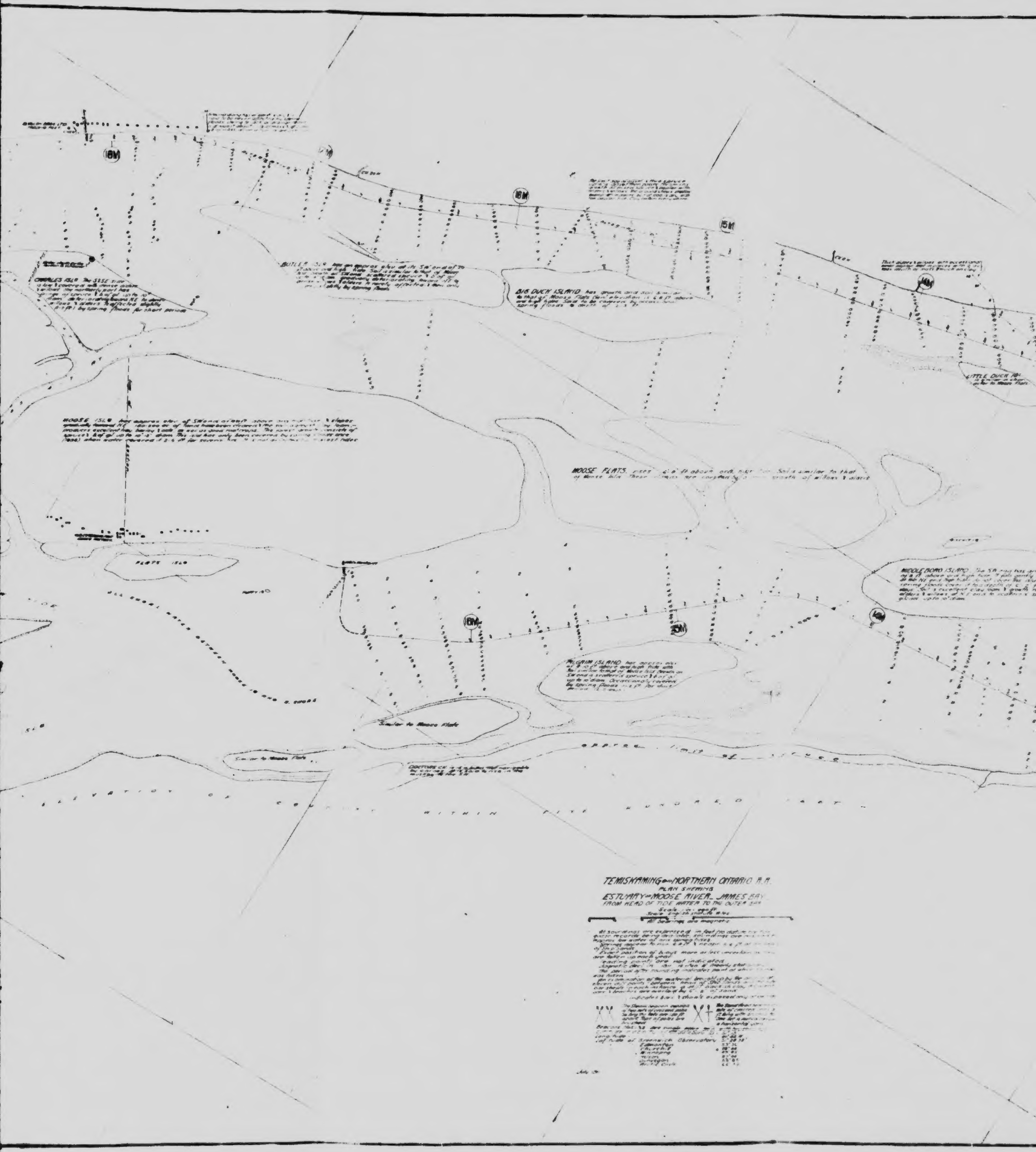

From Hay Island south the west shore is apparently free from serious effects of high water. There are occasional bluffs of balm of gilead & of spruce upland with growth of raspberry bushes alders etc. Soil a fertile buff coloured clay.
South from "B" shores rise abruptly to general level of country. Belt of spruce borders the river as far as "B"
Between "B" and south end of Hay Island scrub alder & willow with frequent bluffs of spruce & balm of gilead
COUNTRY
LOW
LYING
ALMOST
LEVEL


6M
7M
8M
Site of abandoned H.B.'s Hannah Bay Post. This site is said to have been
affected by any stage of high water.
TEMISKAMING AND NORTHERN ONTARIO R R
PLAN SHEWING
ESTUARY OF THE HARRICANAW RIVER HANNAH BAY
LEVEL
WITH
MOSS
ROCK

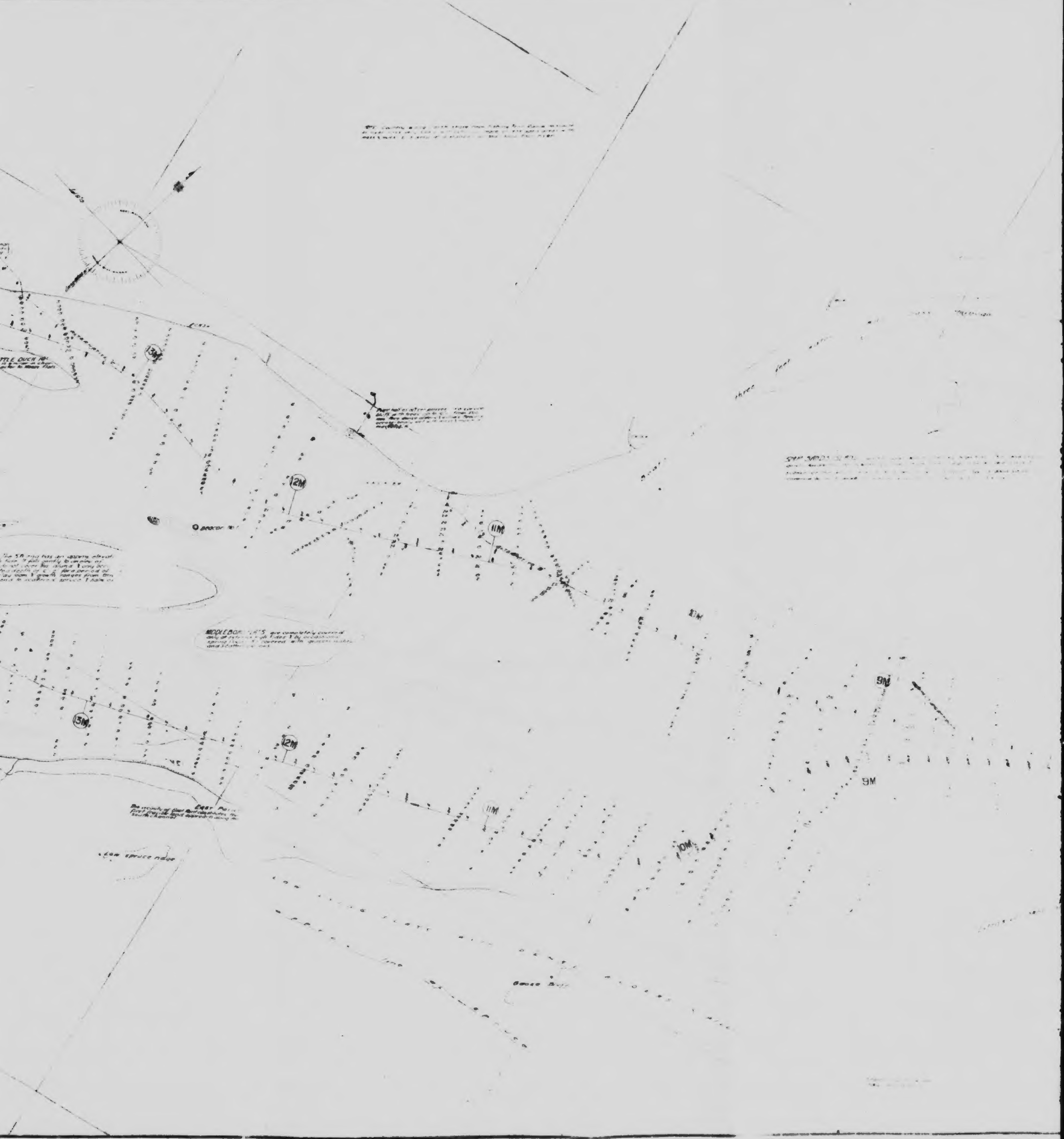

4M
3M
2M
1M

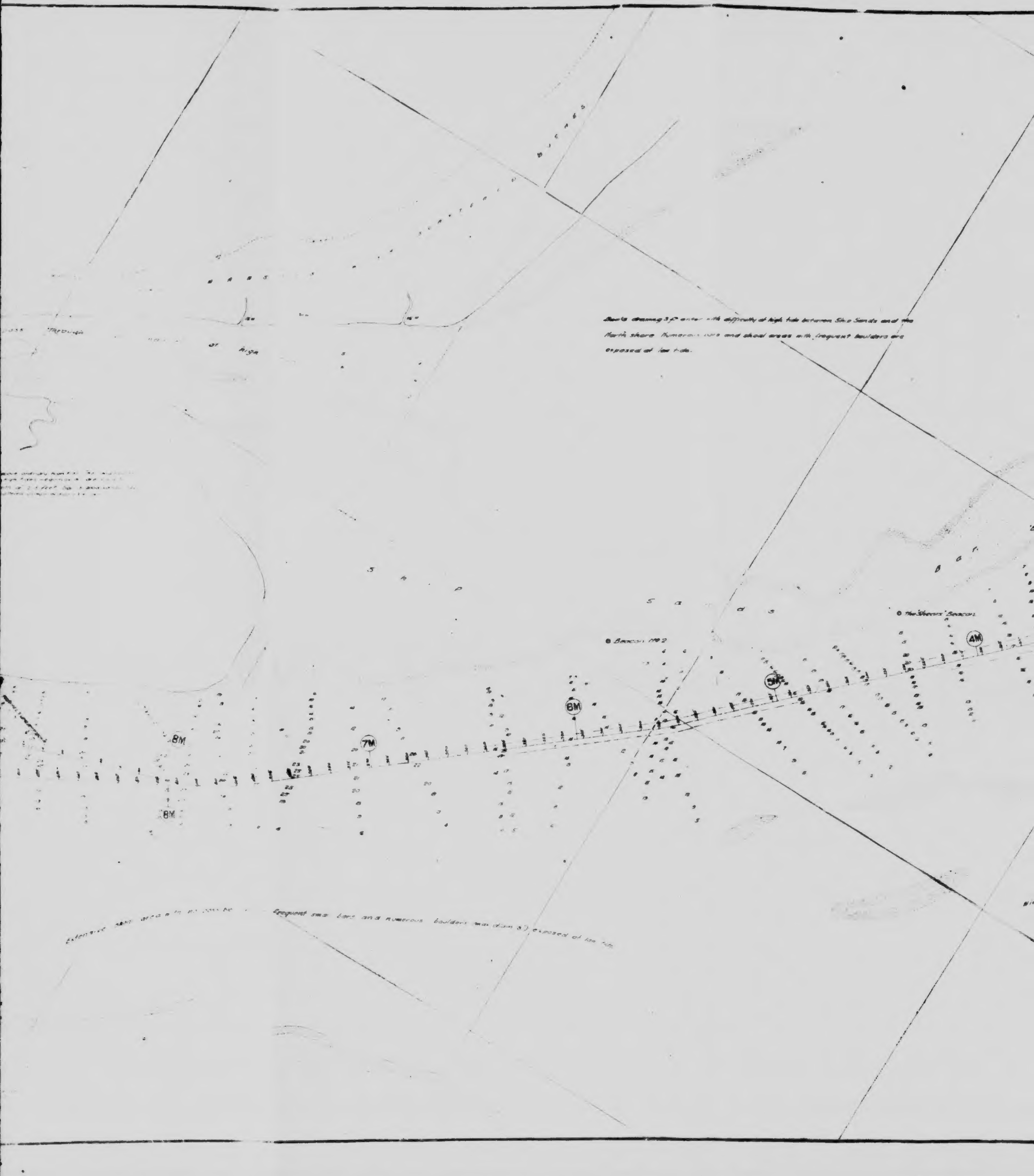
SHINGLE ISL.D
SHINGLE ISLANDS.
SHINGLE ISL.D

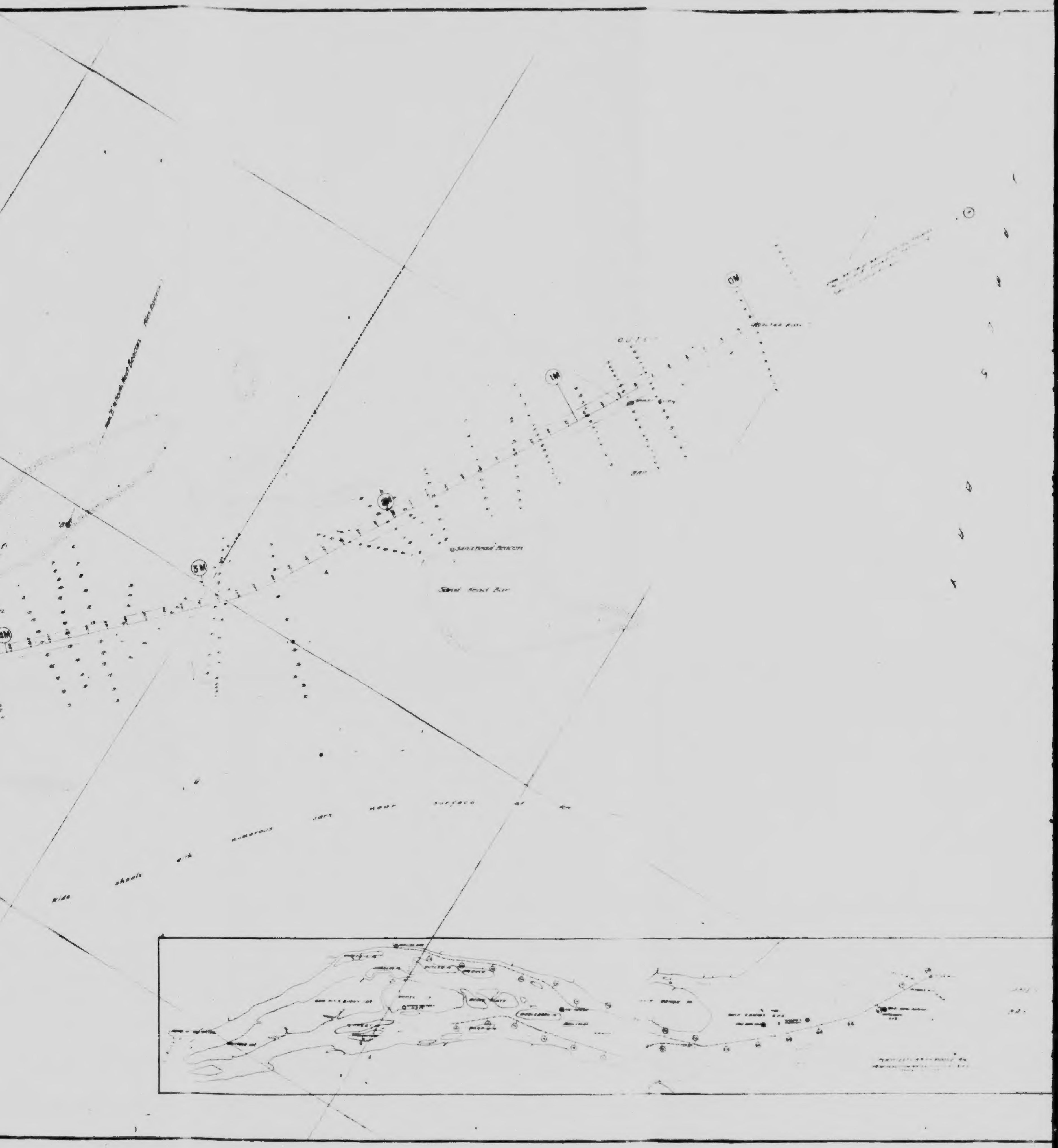
SAW PIT & BUSNY ISLANDS
BM
BUTLER ISLD
BUSHY ISLD
E.S AT LOW
SHOALS AND
LESS WATER THAN TO NORTH OF
higher ground


18M
17M
16M
15M
14M
CHARLES ISL'D
BUTLER ISL'D
BIG DUCK ISLAND has growth and soil similar to that of Moose Flats
LITTLE DUCK ISL'D
MOOSE ISL'D
MOOSE FLATS rises … ft above ord. high tide. Soil is similar to that of Moose Isl'd. These … are covered by a … growth of willows & alders
FLATS ISL'D
MIDDLEBORO ISLAND
PILGRIM ISLAND
Similar to Moose Flats
Similar to Moose Flats
APPROX. LIMIT OF …
ELEVATION OF COUNTRY WITHIN FIVE HUNDRED FEET
All bearings are magnetic
Edmonton
Churchill
Winnipeg
Dunvegan
Arctic Circle

TEMISKAMING AND NORTHERN ONTARIO R.R.
PLAN SHEWING
ESTUARY OF MOOSE RIVER, JAMES BAY
FROM HEAD OF TIDE WATER TO THE OUTER BAR


13M
13M
12M
12M
11M
11M
11M
10M
10M
9M
9M
Beacon No 1
MIDDLE BORO FLATS are completely covered only at extreme high tides & by occasional spring floods
East Point
Low spruce ridge
three

Boats drawing 3 ft enter with difficulty at high tide between Ship Sands and the North shore. Numerous [illegible] and shoal areas with frequent boulders are exposed at low tide.
S h i p
S a n d s
B a r
Beacon No 2
The 'Sheers' Beacon
4M
5M
6M
7M
8M
8M
Frequent sma[illegible] bars and numerous boulders [illegible] exposed at low tide
Extensive [illegible] area [illegible]
Through
High


North West Beacon
4M
3M
2M
1M
0M
OUTER
BAR
Sand Head Beacon
Sand Head Bar
Wide shoals with numerous bars near surface at